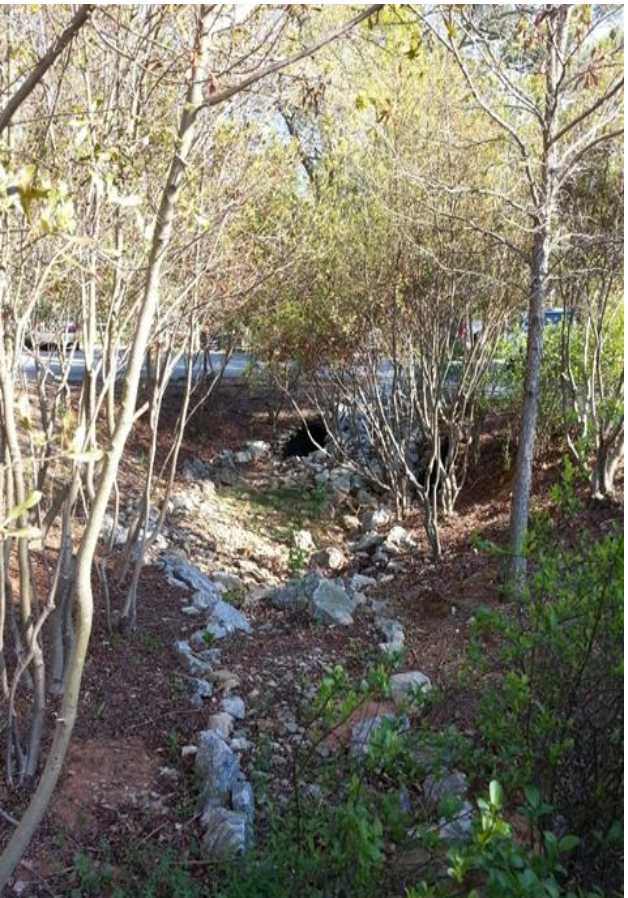
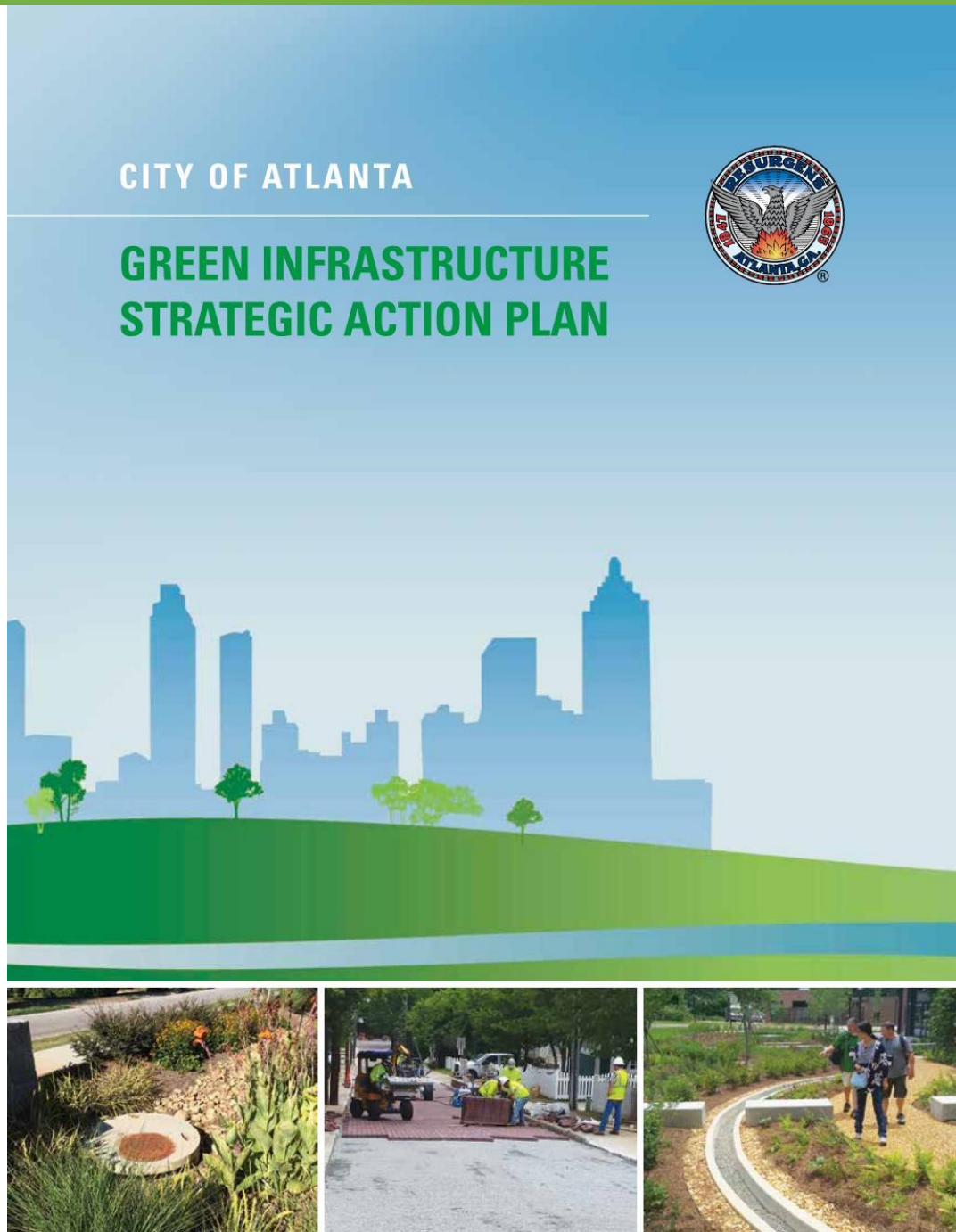
LID/GI and BMP Case Studies



Metro Atlanta

- Goal – Reduction of runoff volume and pollutant load
- Aesthetic improvement/revitalization
- Opportunistic project implementation
- Policy, funding, and planning
- Partnering and outreach
- Data tracking and technical analysis

It is my goal for Atlanta to become one of the top-tier sustainable cities in the nation. - Mayor Kasim Reed



Boone Boulevard Complete Streets Project

Boone Boulevard Complete Streets Project

Stormwater Credits in Roswell

How do the Credits Work?

Property owners and developers may purchase stormwater credits to meet some or all of their stormwater treatment requirements. Aesthetic improvement/revitalization

- A credit is a unit of stormwater treatment that can purchased to partially or fully meet the WQ treatment required for site development
- Credit units are sold by impervious acre treated
- Credit costs are determined by fair market value of similar on-site treatments or by the full project cost borne by City
- Credit costs will vary by location and stormwater facility
- Credits are available on a first come/first serve basis
- The City tracks available credits per facility, what has sold, and what is available

City of Portland Green Streets GI Design and Construction

- Large-scale application of GI/Low Impact Development (LID)

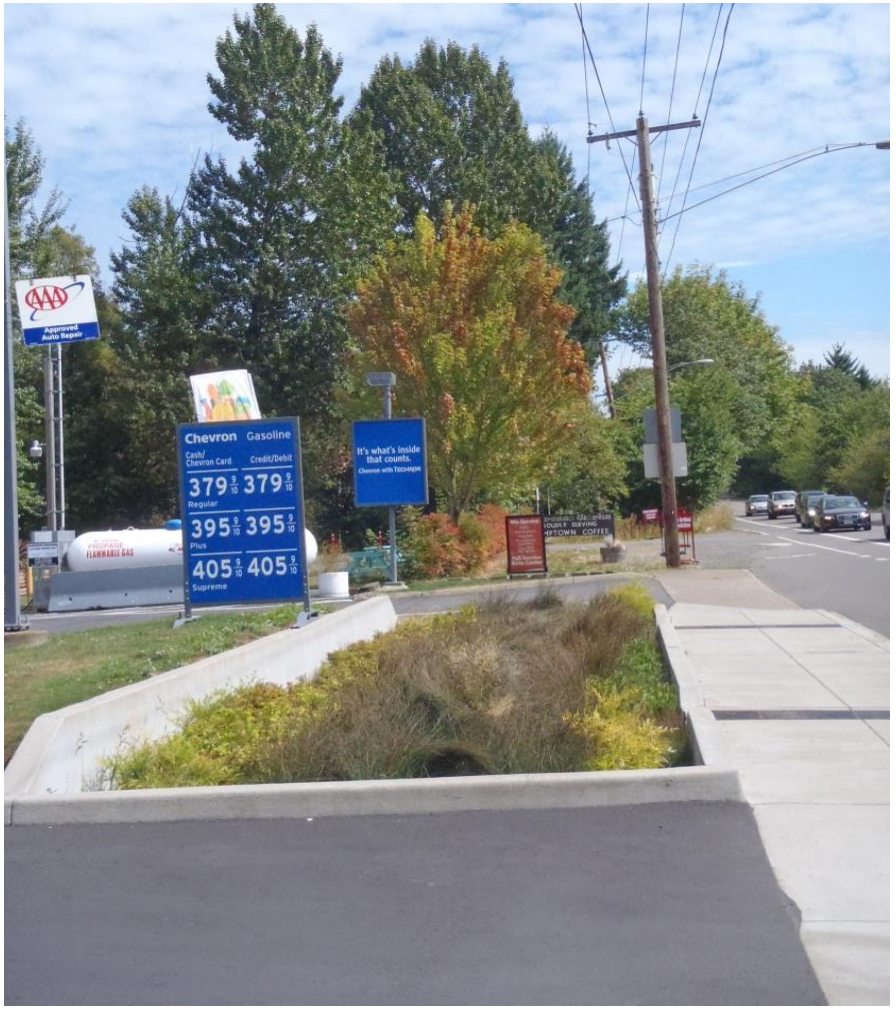
Multnomah Boulevard Green Streets

Before

After

Multnomah Boulevard Green Streets

Before



After

Washington, DC

Issue

- TMDL load reduction requirements
- Goal of local job creation
- Skills needed beyond typical landscaping

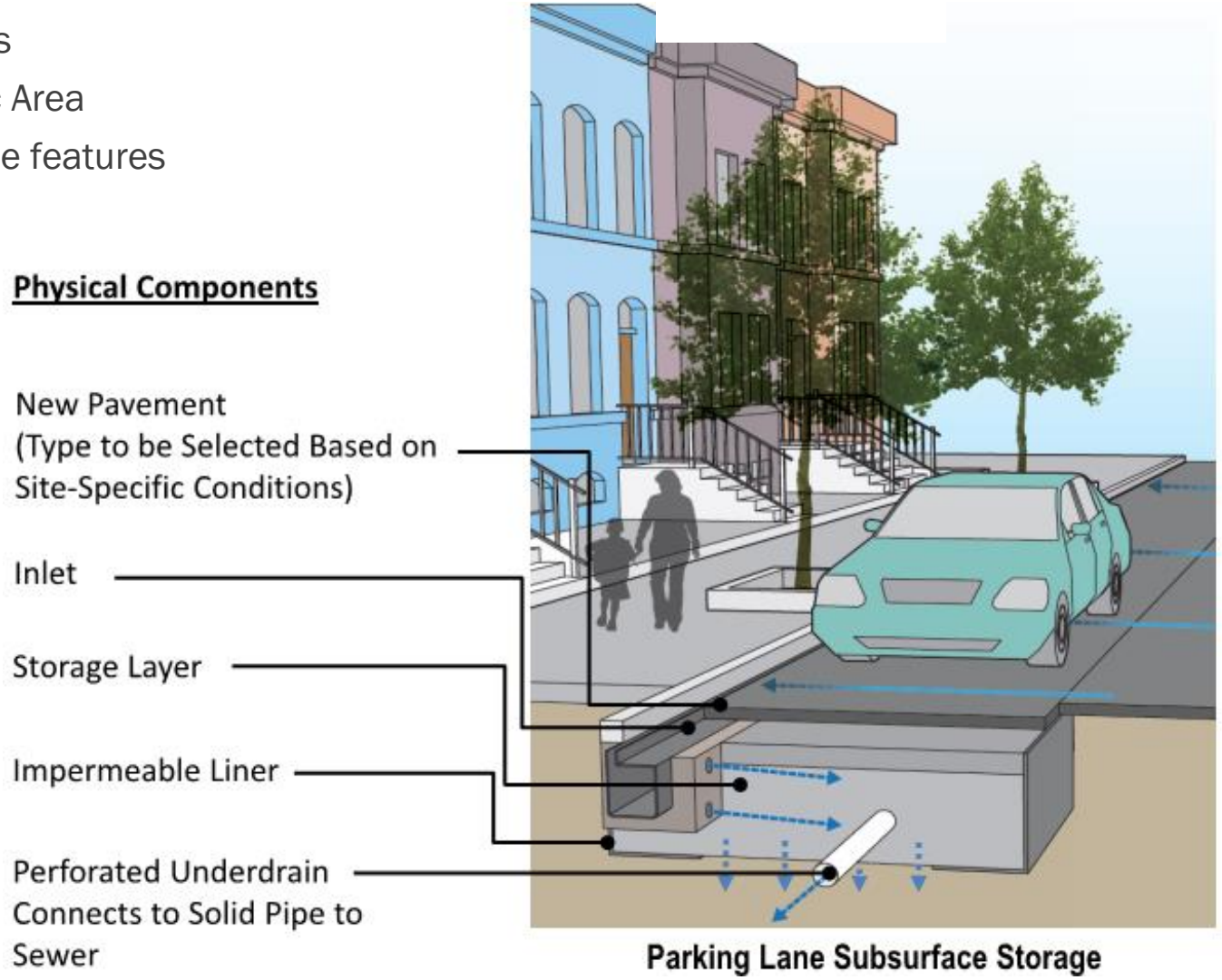
Opportunity

- Maintenance Certification Program
  - DC Water/WEF collaboration
  - National - 15 municipal partners
  - Skilled labor pool - install, inspect and maintain

Standard Details

Washington, DC

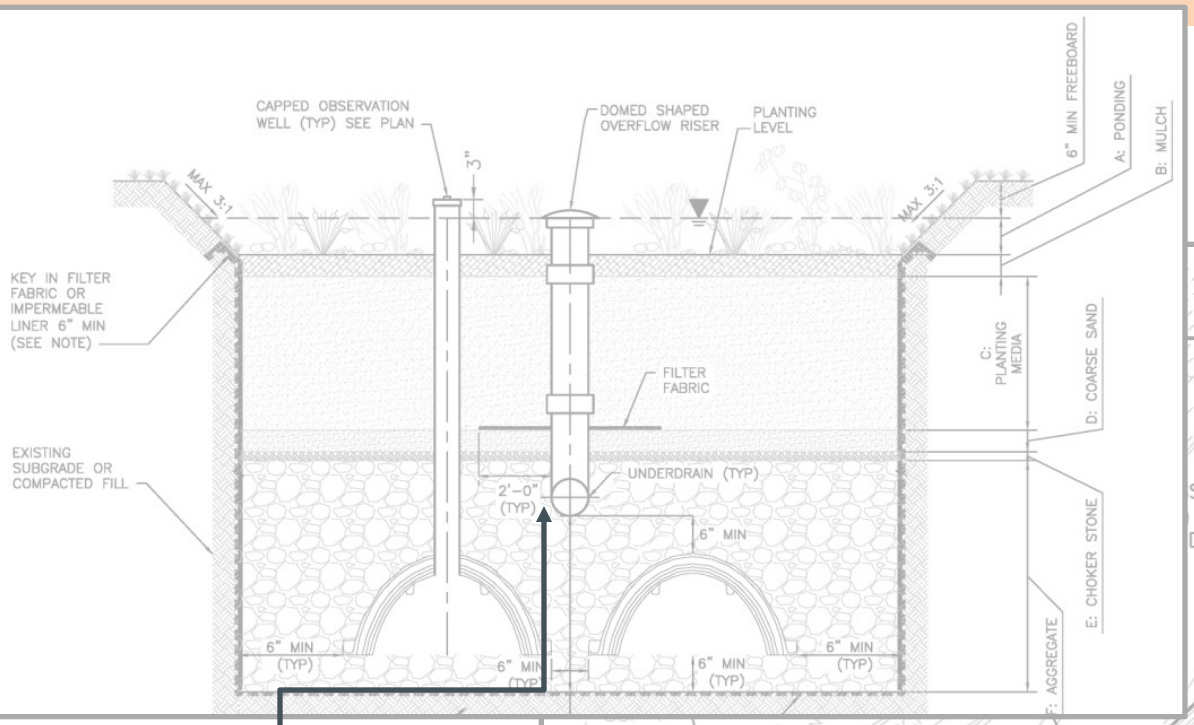
- Modified for Local Needs
  - Georgetown Historic Area
  - No change to surface features



GI and Resiliency

Washington, DC

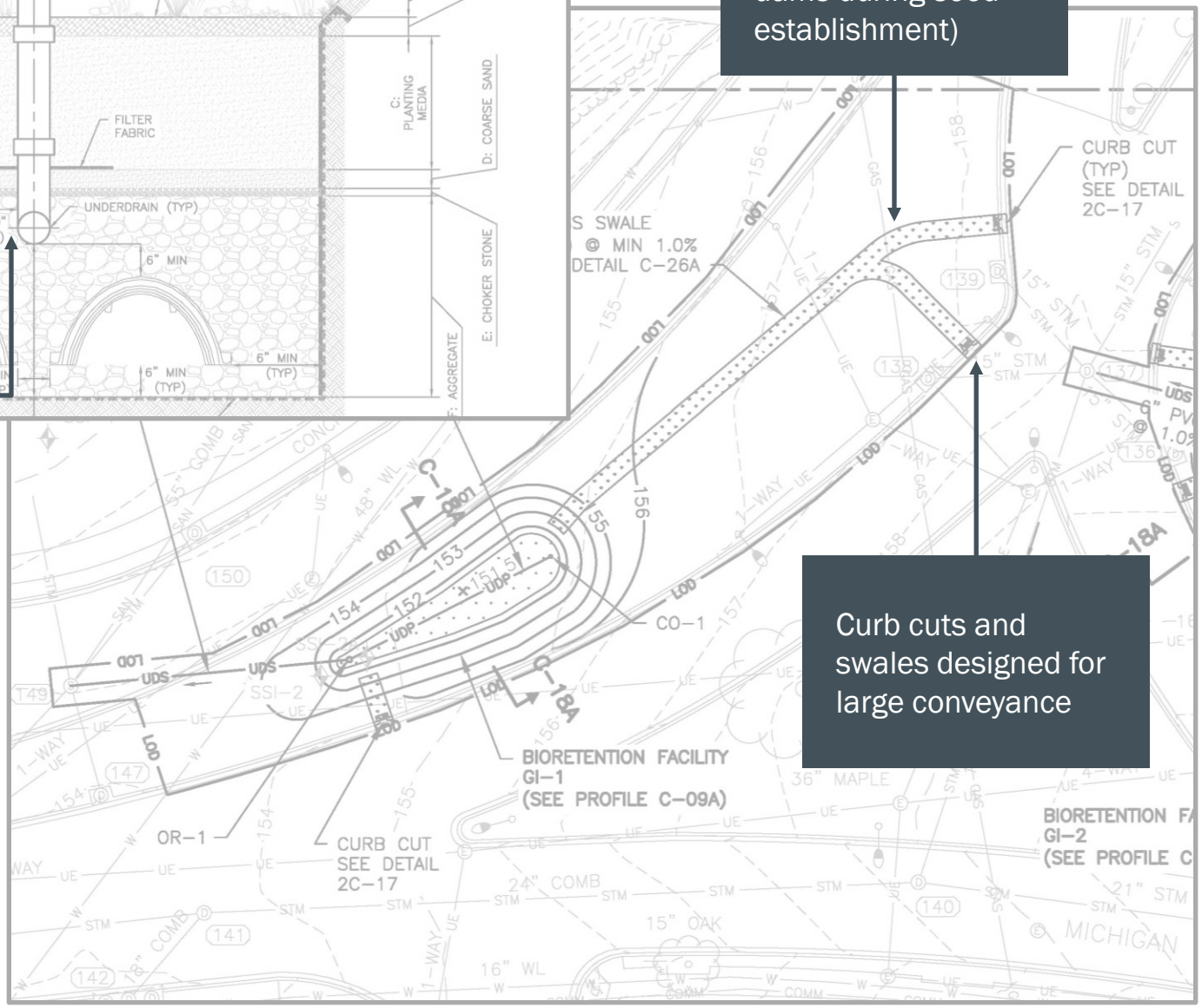
Date	Duration	Rainfall (inches)	NOAA Point Precipitation Frequency
7/10/2012	1-hr	1.96	10-year storm
7/18/2012	30-min	1.35	5-year storm
7/19/2012	15-min	0.94	5-year storm
9/02/2012	2-hr	2.78	10-year storm



Shallow grassed swales (temp. check dams during seed establishment)

Deep storage with large void space and underdrain

Curb cuts and swales designed for large conveyance



Cleveland, OH

Issue

- Increasing GI sites and lack of maintenance
- Public complaints on aesthetics
- Landscape contractors lack skills

Opportunity

- 3rd Party Property Management Model
- One-stop shopping for large regional sites
  - Vegetative and non-vegetative
  - Inspection and testing
  - Community engagement
  - Approx. $1/sq ft of surface area

Oriana House Employment Program provides **ex-offenders with green jobs**

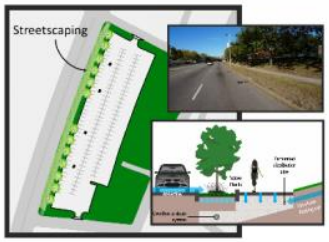
Boston, MA

Issue

- TMDL - 65% TP reduction in Charles River
- Cost effective, large–scale urban retrofits
- Maximize Triple Bottom Line

Opportunity

- Screen alternatives
- Non-Cost factors such as O&M requirements



	Bioswale	Bioswale + rain garden	Porous pavement	Streetscaping
Construction costs	$145K	$216K	$596K	$319K
Phosphorus reduction	1.4 lb	2.3 lb	2.2 lb	3.2 lb
$/lb P removed	$7.2K	$6.3K	$16.6K	$6.5K
O&M requirements				
Public impacts/benefits				
Flood mitigation				
Reliance on 3rd parties				
Overall score				

Best → Worst

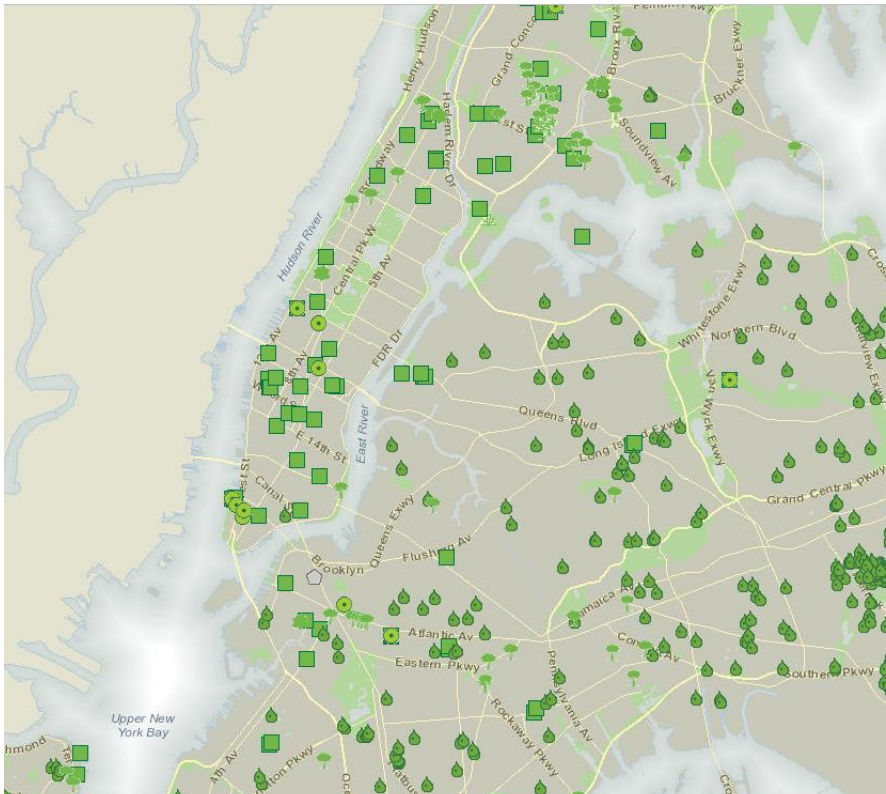
New York, NY

Issue

- Growing GI sites – approx. 4,500 bioswales
- Tracking and reporting
  - Performance
  - Maintenance

Opportunity

- Web-based asset management program
- Integrated GIS and data management



NYC

Implementation Strategies

Public Property Retrofits

Grant Program for Private Property

Right-of-Way Green Infrastructure

NYC

Right-of-Way Bioswale (ROWB)

Pros

- Fast track siting (DOT clearances) and design
- Limited permits or MPT
- Cost-effective
- Scalable performance and asset management

Cons

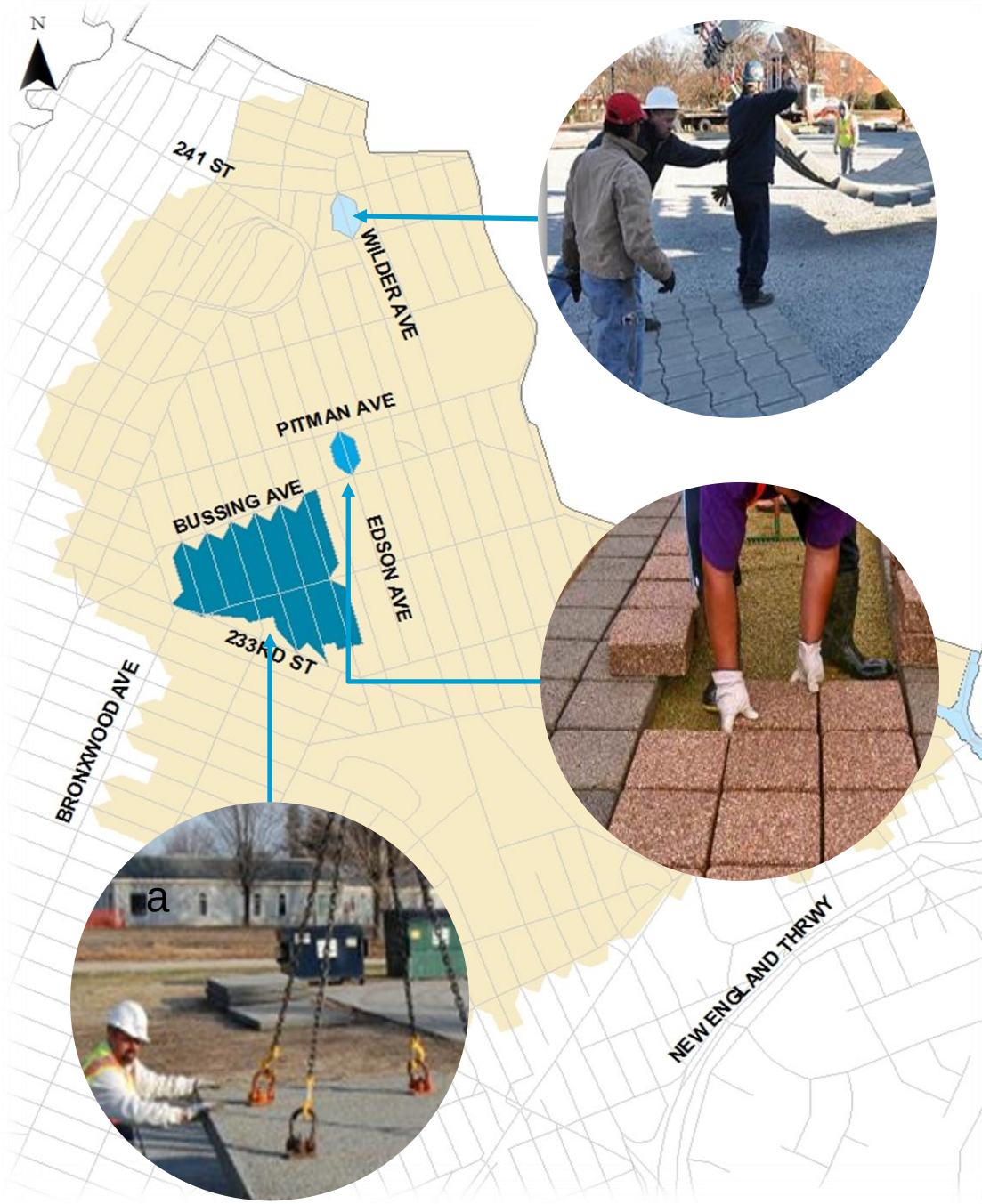
- Clearances
- Multiple needed per block
- No underdrains, need good soils

NYC

Permeable Pavement

Piloting in ROW

- Residential side street (non arterial)
- Parking lane only
- 3 different technologies
  - Pavers
  - Cast in place concrete
  - Precast concrete panels

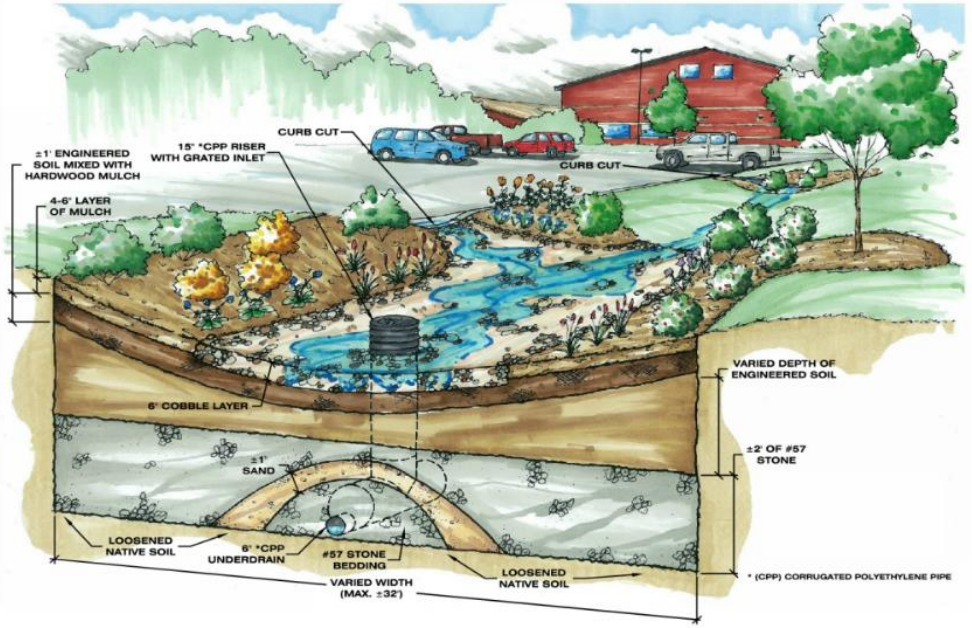


Gwinnett County DWR Retrofit

Demonstration Project

DWR Main Facility

- County Property
- Public Access/Education Opportunity
- Training for Developers
- Long Term Monitoring



Bush Creek Pre and Post Comparison

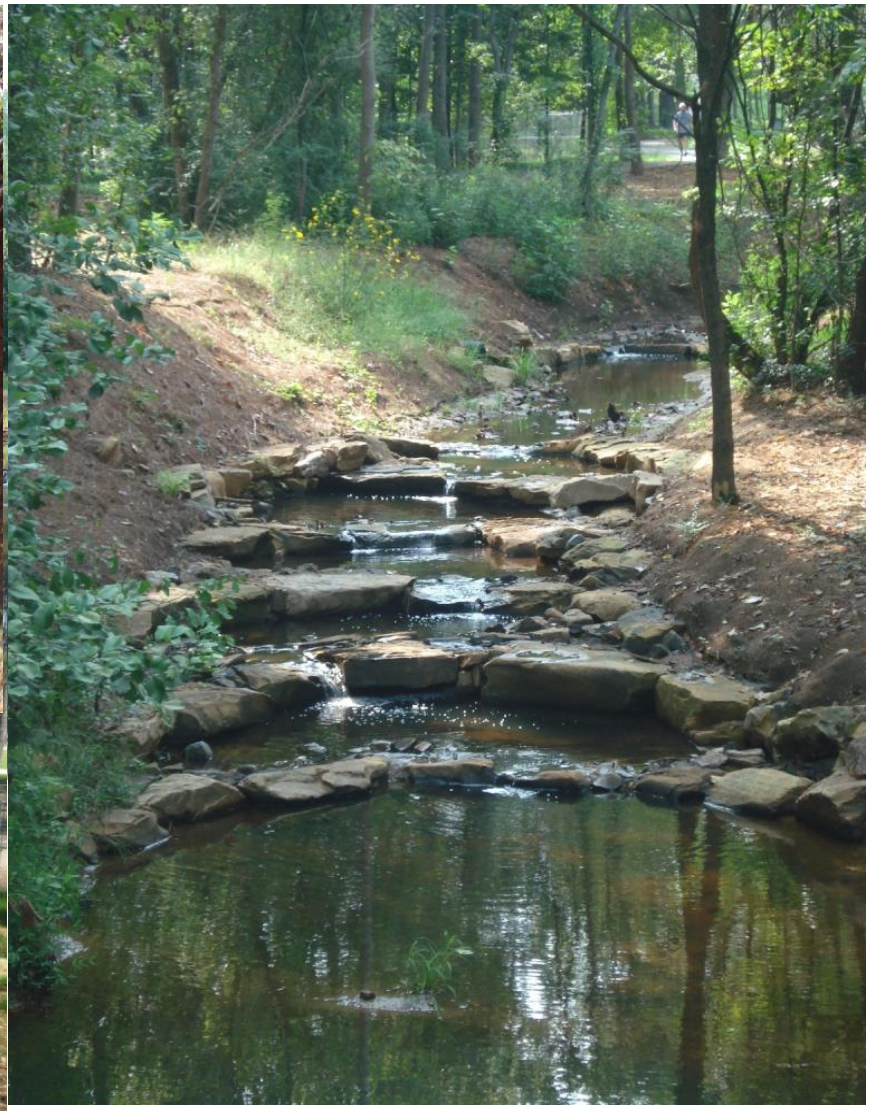
Pre-project

Post-project

Pre-project

Post-project

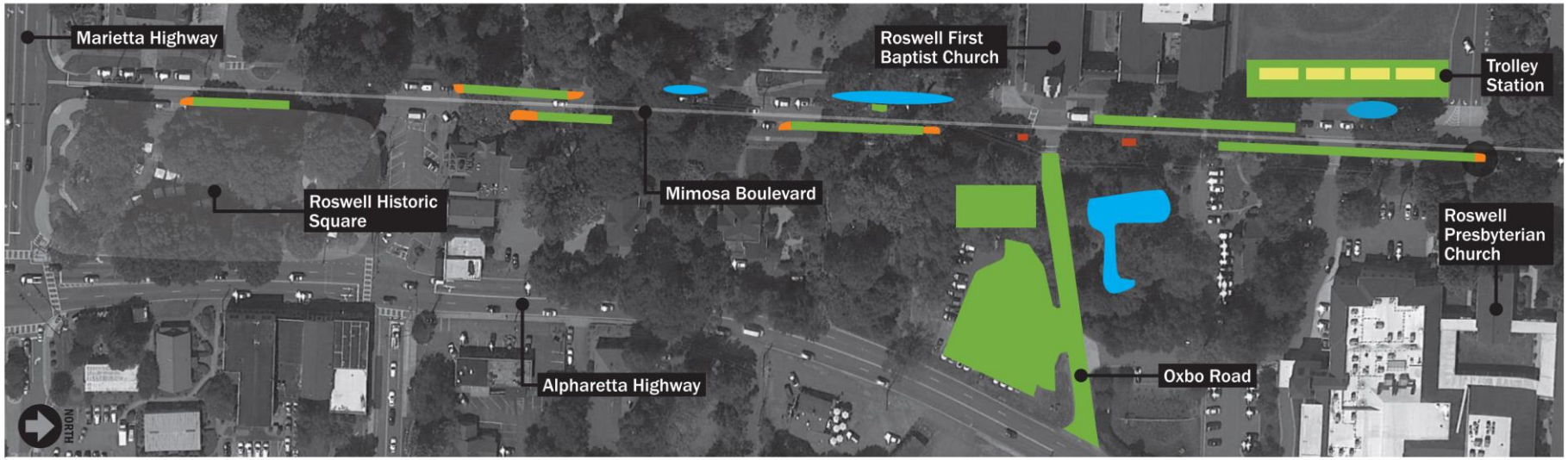
Ronald Reagan Park Stream Restoration



Morrow City Hall Permeable Paver Retrofit

Mimosa Boulevard Urban Tree and Green Infrastructure Concepts

(SOUTH END OF MIMOSA BOULEVARD)



KEY /// Bioretention Area | Curb Bumpout/Sidewalk Planter | Tree Box (Filterra or Similar) | Pervious Pavers | Restore Urban Tree Canopy

Bioretention Area

Install functional garden area within street right-of-way or on private property to improve water quality and flooding issues while improving property aesthetics. Also reduces carbon footprint and urban heat island impacts.

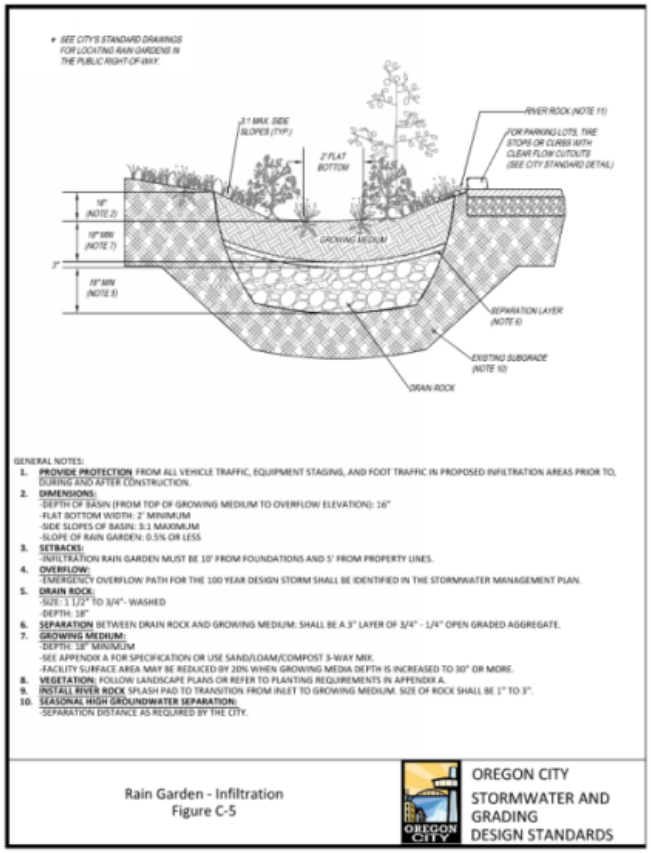
Curb Bumpout/ Sidewalk Planter

Install small functional traffic calming garden area within street right-of-way. Garden like area adjacent to street will improve water quality, reduce flooding, and beautify street. Also reduces carbon footprint and urban heat island impacts.

Oregon City

Design Standards

- Includes O&M Plan
  - What to look for
  - What to do
  - Schedule



* SEE CITY'S STANDARD DRAWINGS FOR LOCATING RAIN GARDENS IN THE PUBLIC RIGHT-OF-WAY.

GENERAL NOTES:

1. **PROVIDE PROTECTION** FROM ALL VEHICLE TRAFFIC, EQUIPMENT STAGING, AND FOOT TRAFFIC IN PROPOSED INFILTRATION AREAS PRIOR TO, DURING AND AFTER CONSTRUCTION.
2. **DIMENSIONS:**
   -DEPTH OF BASIN (FROM TOP OF GROWING MEDIUM TO OVERFLOW ELEVATION): 16"
   -FLAT BOTTOM WIDTH: 2' MINIMUM
   -SIDE SLOPES OF BASIN: 3:1 MAXIMUM
   -SLOPE OF RAIN GARDEN: 0.5% OR LESS
3. **SETBACKS:**
   -INFILTRATION RAIN GARDEN MUST BE 10' FROM FOUNDATIONS AND 5' FROM PROPERTY LINES.
4. **OVERFLOW:**
   -EMERGENCY OVERFLOW PATH FOR THE 100 YEAR DESIGN STORM SHALL BE IDENTIFIED IN THE STORMWATER MANAGEMENT PLAN.
5. **DRAIN ROCK:**
   -SIZE: 1 1/2" TO 3/4"- WASHED
   -DEPTH: 18"
6. **SEPARATION** BETWEEN DRAIN ROCK AND GROWING MEDIUM: SHALL BE A 3" LAYER OF 3/4" - 1/4" OPEN GRADED AGGREGATE.
7. **GROWING MEDIUM:**
   -DEPTH: 18" MINIMUM
   -SEE APPENDIX A FOR SPECIFICATION OR USE SAND/LOAM/COMPOST 3-WAY MIX.
   -FACILITY SURFACE AREA MAY BE REDUCED BY 20% WHEN GROWING MEDIA DEPTH IS INCREASED TO 30" OR MORE.
8. **VEGETATION:** FOLLOW LANDSCAPE PLANS OR REFER TO PLANTING REQUIREMENTS IN APPENDIX A.
9. **INSTALL RIVER ROCK** SPLASH PAD TO TRANSITION FROM INLET TO GROWING MEDIUM. SIZE OF ROCK SHALL BE 1" TO 3".
10. **SEASONAL HIGH GROUNDWATER SEPARATION:**
    -SEPARATION DISTANCE AS REQUIRED BY THE CITY.

Rain Garden - Infiltration
Figure C-5

OREGON CITY
STORMWATER AND GRADING DESIGN STANDARDS

Rain Gardens
Operations & Maintenance Plan

What to Look For	What to Do
Structural Components, including inlets and outlets/overflows, shall freely convey stormwater.	
Clogged inlets or outlets	-Remove sediment and debris from catch basins, trench drains and curb inlets and pipes to maintain at least 50% conveyance capacity at all times.
Cracked Drain Pipes	-Repair/seal cracks. Replace when repair is insufficient.
Check Dams	-Maintain 4 to 10 inch deep rock check dams at design intervals.
Vegetation	
Dead or strained vegetation	-Replant per original planting plan, or substitute from Appendix A. -Irrigate as needed. Mulch banks annually. DO NOT apply fertilizers, herbicides, or pesticides.
Tall Grass and Vegetation	-Cut back grass and prune overgrowth 1-2 times per year. Remove cuttings.
Weeds	-Manually remove weeds. Remove all plant debris.
Growing/Filter Medium, including soil and gravels, shall sustain healthy plant cover and infiltrate within 72 hours.	
Gullies	-Fill, lightly compact, and plant vegetation to disperse flow.
Erosion	-Replace splash blocks or inlet gravel/rock.
Slope Slippage	-Stabilize 3:1 slopes/banks with plantings from Appendix A.
Ponding	-Rake, till, or amend to restore infiltration rate.

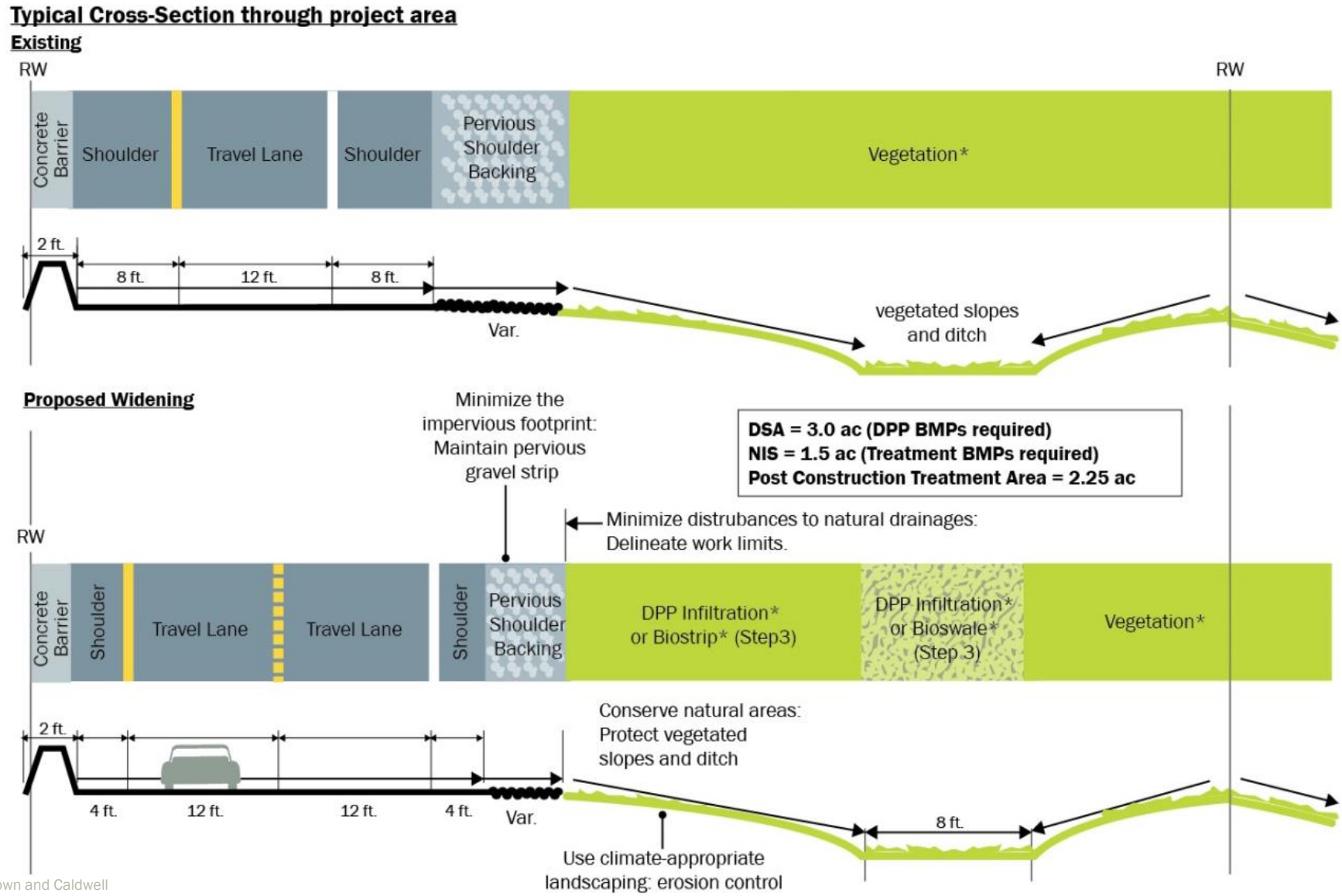
Annual Maintenance Schedule:

Summer. Make any structural repairs. Improve filter medium as needed. Clear drain. Irrigate as needed.
Fall. Replant exposed soil and replace dead plants. Remove sediment and plant debris.
Winter. Monitor infiltration/flow through rates. Clear inlets and outlets/overflows to maintain conveyance.
Spring. Remove sediment and plant debris. Replant exposed soil and replace dead plants. Mulch.
All seasons. Weed as necessary. Clean scuppers or curb cuts as needed.
Maintenance Records: Record date, description, and contractor (if applicable) for all structural repairs, landscape maintenance, and facility cleanout activities. Keep work orders and invoices on file and make available upon request of the inspector.
Access: Maintain ingress/egress to design standards.
Infiltration/Flow Control: All facilities shall drain within 72 hours. Record time/date, weather, and site conditions when ponding occurs.
Pollution Prevention: All sites shall implement best management practices to prevent hazardous or solid wastes or excessive oil and sediment from contaminating stormwater. Contact emergency response agencies for immediate assistance responding to spills. Record time/date, weather, and site conditions if site activities contaminate stormwater.
Vectors (Mosquitoes & Rodents): Stormwater facilities shall not harbor mosquito larvae or rats that pose a threat to public health or that undermine the facility structure. Monitor standing water for small wiggling sticks perpendicular to the water's surface. Note holes/burrows in and around facilities. Call Clackamas County Vector Control for immediate assistance to eradicate vectors. Record time/date, weather, and site conditions when vector activity observed.

Rain Garden - O&M Plan
Figure C-6

OREGON CITY
STORMWATER AND GRADING DESIGN STANDARDS

CalTrans BMP Consideration – in ROW

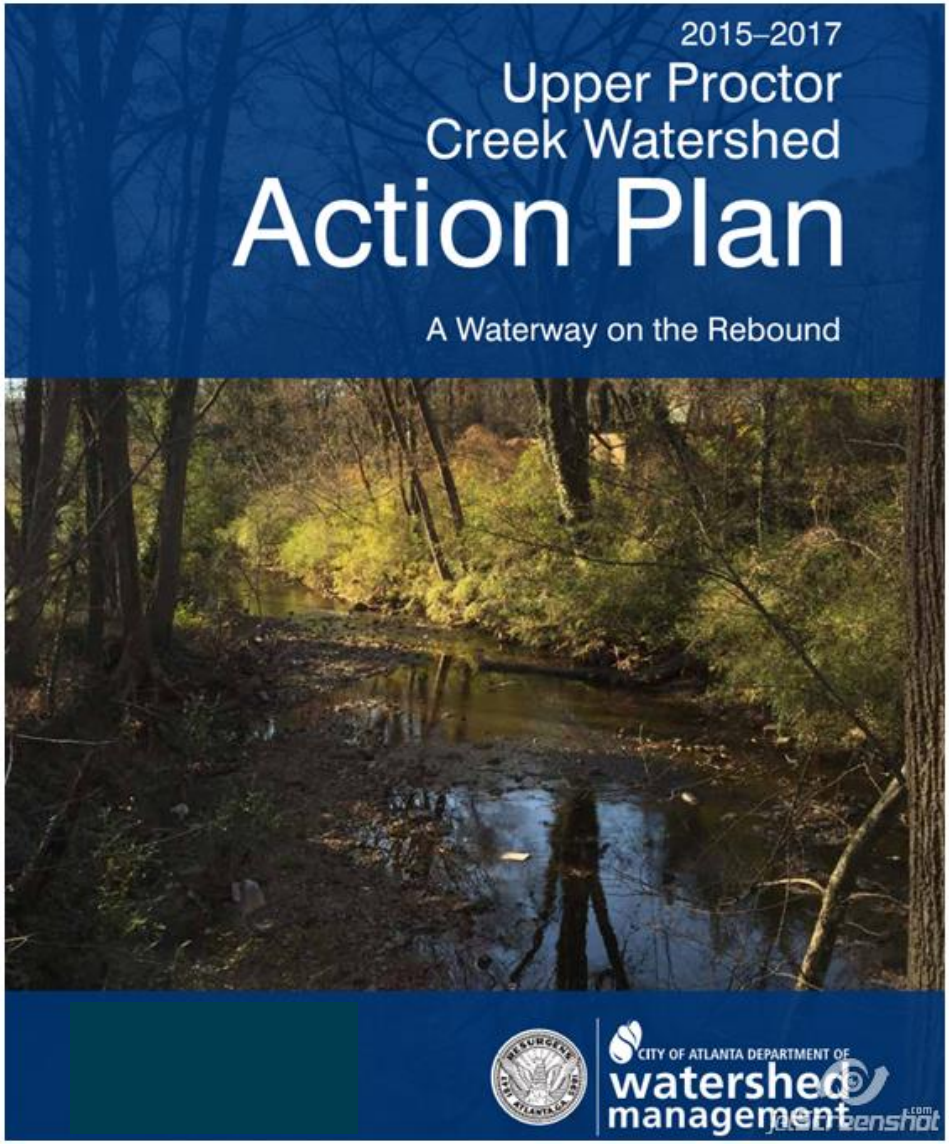



OXYGEN
MAXON

Dixie Drain Nutrient Offset


SIMONA
SIMONA

Effective Communication



Upper Proctor Creek Watershed
ACTION PLAN

Mayor Kasim Reed and the Department of Watershed Management (DWM) are committed to improving and protecting the health of one of our community's most vital assets—the Upper Proctor Creek Watershed—and believe that efforts to improve this watershed are an opportunity to enhance the quality of life for those who live and work here.

The Upper Proctor Creek Watershed lies in the very heart of Atlanta, home today to more than 50,000 residents across 35 neighborhoods. These 18 square miles play an important role in protecting the water bodies that supply our drinking water, provide habitat for wildlife, and offer opportunities for recreation. Addressing the amount and quality of stormwater in the watershed is critical to reducing sewer overflows and stream bank erosion, and preventing pollutants from washing into the creek. Even more, Proctor Creek's ecological health directly impacts areas downstream—from fewer trees falling into the creek, to less trash, to healthier aquatic habitat.

The watershed is a focus area of the Urban Waters Federal Partnership, and its revitalization is a priority for federal agencies as well as local stakeholders. Over the next several years, DWM is planning to leverage this support and invest $50 million in the watershed with projects that improve water and wastewater infrastructure, provide combined sewer capacity relief, deliver water quality improvements, and enhance our community's public spaces for years to come.

Read on to learn about DWM's plan to implement the right mix of projects to deliver lasting social, economic, and environmental benefits to the Upper Proctor Creek Watershed and surrounding neighborhoods.

The cleanup of Proctor Creek will be yet another step that the City of Atlanta is taking toward being a world-class, sustainable city. It follows our efforts to clean up the Chattahoochee River and create a clean and enjoyable waterway for future generations.

—Mayor Kasim Reed

social
New ways to enjoy and access community areas and neighborhoods via trails, parks, recreation areas, and greenspace

economic
Partnerships with planned parks and greenways to improve property values and promote development and redevelopment

environmental
Combined sewer capacity relief, flood protection, and water quality improvements to protect human and wildlife health


Westside Park Pond
Proctor Park
Boone Boulevard


Westside Park Pond
Proctor Park
Boone Boulevard

Recreational and Educational Elements

Include recreational elements to allow a stormwater treatment system to be useful to the public and a benefit to community

QUESTIONS?

it's about connecting

Brown AND Caldwell essential ingredients®